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Schooling and Urban Employment Growth

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This study is an empirical analysis of employment changes in urban counties in the United States between 1980 and 1984. Particular attention is paid to the effects of schooling attainment and education expenditures on employment changes. The results show that schooling attainment (median years of schooling) helps promote employment growth. Also, it is demonstrated that the industry mix in 1980 has affected employment changes since 1980. The direct effect of educational spending on employment changes is weak and statistically insignificant. It does, however, have an important and highly significant impact on the enrollment in high school of youths 16 to 17 years of age.

I. Introduction

This study is an empirical analysis of urban employment changes between 1980 and 1984. The article follows other recent work on the economics of urban and regional employment growth in the United States (Benson and Johnson, 1986; Carlino and Mills, 1987; Carlton, 1983; Doeringer, Terkla, and Topakian, 1987; Helms, 1985; Plaut and Pluta, 1983; Wasylenko and McGuire, 1985). It pays particular attention to the effects of schooling on employment. It is shown that for counties that are at least 90% urban, schooling attainment helps promote employment growth. Expenditures on education, however, could not be shown to affect employment changes. Also, it is demonstrated that the industry mix in a county in 1980 affected employment changes since 1980.

This article is part of a larger study of urban and rural employment changes in the United States. It was our aim to show the differential effects of education on employment growth in urban and rural counties. For the rural counties, we could not show any significant relationships between measures of education and employment growth. In this article, we shift the focus to results for urban counties.

To some extent, related studies do not provide a consistent story on the relationship between measures of education and local employment growth. For example, Plaut and Pluta (1983) find a negative correlation between educational attainment and state employment growth. Doeringer, Terkla, and Topakian (1987) find that neither educational attainment nor expenditures on education increase state employment or employment in areas within Massachusetts. In contrast, several other studies suggest a positive

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relationship between expenditures on education and employment growth (Helms, 1985; Wasylenko and McGuire, 1985).

The article is organized as follows: First comes a brief theoretical discussion, followed by the presentation of the empirical model and the data. Third, the empirical results are reviewed, and, fourth, policy implications are examined. The paper closes with a summary of the findings.

II. Theoretical Considerations

Why does one region grow at a rate different from that of another region? Economic theory suggests that, ceteris paribus, there exists a positive relationship between the quality of a factor of production and the extent of its employment. In particular, it implies that the level of employment is positively related to the quality of a region's labor force. This insight from static theory is extended to explain employment changes over time.

Schooling provides the foundation for the acquisition of job skills. A well-educated labor force is able to learn new skills and do new tasks relatively easily. It has the potential to adjust to, and benefit from, changing economic conditions. We therefore expect that investments in education and employment growth are positively correlated. This positive relationship is weakened if workers display a high degree of mobility. A region may lose some of its human capital investment to other regions, or it may benefit from educational spending by other regions through immigration or commuting. The geographically smaller the region, the more likely it is that such spillovers are significant.

Members of the labor force with children are concerned about the quality of a region's educational system. Parents may forgo a promising job opportunity if it requires a move detrimental to their children's education. Thus, regions that have a strong educational system are expected to be at an advantage in attracting workers. Firms recognize this and tend to favor the same regions as it is easier for them to attract and retain workers.

In determining a region's success at achieving employment growth, therefore, there are three major groups of decision makers: governments, because they determine the quality and cost of education and other public services; firms; and workers, including their families. The relationship among these will now be discussed.

Households are assumed to pick the location that affords them the greatest utility. For all households, the utility index is a function of consumption and the quality of educational services. The marginal utilities of consumption and the quality of educational services, respectively, are positive but declining. Households pay for their consumption out of after-tax income. Hence, taxes are expected to have a negative impact on utility and a household's desire to locate in a region. The probability of a move from one region to another region where households can achieve a higher utility increases with the gap in the utility levels between the regions.

Firms are assumed to be price takers. Their production activities can be described by a production function. There are two inputs: capital and labor. Capital markets are equally accessible from all regions. Interregional differences in employment growth can therefore be attributed, in part, to the quality and availability of labor. The quality of labor is defined in this study as school attainment (median years of schooling). The higher the attainment level, the more productive the region's labor force.

The effect of a higher attainment level on employment is mixed. On the one hand, a

skilled labor force can produce the same output with fewer workers than a less skilled labor force. On the other hand, if the same number of workers are employed, then the region with the more skilled labor force has the higher marginal productivity. If the wage rates are the same, then the level of employment, ceteris paribus, is higher in the region with the more qualified labor force. Hence, a region with more educated workers can have a higher wage rate, as long as the advantage of the greater skill of the labor force is not offset by higher labor costs.

Government finances its expenditures out of taxes levied on households and capital owners. If the quality of the regional educational system is a function of government expenditures on education, then educational levels are the result of past spending and migration. Migration will improve educational levels if newcomers from regions with better educational systems are in the majority; it will decline otherwise. From this several hypotheses can be derived. The current quality of education affects migration behavior. Regions with better schools are more attractive to households than other regions, ceteris paribus. This allows for some tradeoff between wages and taxes without a loss in a region's ability to retain and attract labor, if expenditures affect the quality of schooling. Most research shows, however, that there is not a close link between expenditures on schooling and educational outcomes (Hanushek, 1986). If this is the case, then higher expenditures on schooling should not have a positive effect on employment growth.

Regions that produce a large share of goods for which demand is stable or increasing are at an advantage over regions whose industries encounter weak demand. That the industrial structure of a region changes slowly implies that the inherited industry mix affects short-run and medium-run employment growth. It also suggests the presence of persistent trends.

III. The Model and Data

Two sets of estimates are undertaken. In the first set, the rate of employment growth between 1980 and 1984 is estimated. An adjustment is made for the industry mix in a county in 1980, because the industrial structure should affect employment changes.

In the second set of estimates, the "differential shift" in county employment growth between 1980 and 1984 is estimated. The differential shift indicates differences in county employment growth that are not explained by industry mix effects. In both cases, industry mix effects are based upon national employment trends in industries for the 1980–1984 period. This approach relies on the "shift-share" methodology that we shall briefly describe. For a more complete explanation see Krueckeberg and Silvers (1974).

Because counties are open economies, their performance depends on events and trends over which they have little influence. Within the United States, it is reasonable to assume that the urban county economy is correlated with the national economy. The growth rate of the urban economy may, therefore, be compared with that of the United States. Take urban employment in the base year ($t = 0$) and multiply it by 1 plus the national employment growth rate between $t = 0$ and $t = 1$. Subtract the result from the observed actual employment of the county at $t = 1$. The difference is the total shift. The formula for the total shift S_i is given by equation (1). L denotes employment. The subscripts i and N stand for region i and nation, respectively, and the superscripts 0 and 1 denote the base and the ending year, respectively.

$$S_i = L_i^1 - \left(L_N^1 / L_N^0\right) L_i^0. \tag{1}$$

If the county grew at a rate above that of the country as a whole, S_i is positive. It is zero if the growth rates coincide, and negative if the county was lagging.

The purpose of shift-share analysis is to separate two different effects that together make up the total shift. If industries with slow national growth rates dominate a county's employment, then one expects that county to grow slowly. This effect is the industry mix effect or proportional shift. The second effect measures the growth of a county's industries compared with that of the same industries for the whole nation. A particular industry may grow slowly (quickly) at the national level, but may grow quickly (slowly) in the county. This is the differential shift D_i.

Equation (2) shows that the differential shift results from the same comparison that was made to obtain the total shift S_i, but on an industry-by-industry basis. The industry results are then added up to give the total number of jobs that the county gained (lost) between $t = 0$ and $t = 1$ because of superior (inferior) performance of its industries compared with the average of these industries for the United States. The additional subscript m denotes different industries. All other symbols retain their meaning.

$$D_i = \sum_{m=1}^{M} \left\{ L^1_{mi} - \left(L^1_{mN} / L^0_{mN} \right) L^0_{mi} \right\}. \tag{2}$$

The industry mix effect, or proportionality shift, P_i, can be obtained as the difference between S_i and D_i. The formula for P_i is

$$P_i = \sum_{m=1}^{M} \left\{ \left(L^1_{mN} / L^0_{mN} \right) - \left(L^1_N / L^0_N \right) \right\} L^0_{mi}. \tag{3}$$

The formula uses the differences between industry growth rates at the national level and the average U.S. growth rate. P_i is negative (positive) if the county's employment base is mostly in slow-growth (fast-growth) industries.

The value of the shift-share formulation for our analysis is clear. It allows us to separate industry mix effects from other reasons for a county's differential employment growth. Theory suggests that counties may experience differences in employment growth for a variety of reasons. One of these reasons, the one that is of particular interest here, is education. By isolating the industry mix effect, the empirical analysis should yield stronger results on the impact of other factors.

Shift-share analysis is a purely descriptive method. It has some weaknesses. Among these the most important is that it takes no account of any changes in the industrial mix between time $t = 0$ and $t = 1$ (see equations (1)–(3)) (Herzog and Olsen, 1977). This becomes a serious problem when the study period is long or when the economy is undergoing rapid structural changes. During the period 1980–1984, manufacturing and agriculture were undergoing significant changes. The differential shift is therefore likely to be a biased measure of comparative industry performance of counties with large employment in 1980 in these two sectors relative to other counties. The bias can be positive or negative. We assume that it is normally distributed around zero and can be added to the error term. The dependence on the industrial structure in the base year also leads to instability of the differential shift over time. For the purpose of this article this is not a problem, however, since we are not comparing different time periods.

Our approach follows Doeringer, Terkla, and Topakian's (1987) study of state and

local growth. Many related studies do not take into account industry mix effects (e.g., Plaut and Pluta, 1983; Helms, 1985; Wasylenko and McGuire, 1985). Some studies focus on a particular sector, such as manufacturing (e.g., Carlino and Mills, 1987).

Apart from adjusting for industry mix, we also control for schooling attainment and schooling expenditures in 1980. Schooling attainment is measured as the median years of schooling completed by the population aged 25 years and older. Schooling expenditures are measured per pupil in primary and secondary schools. Schooling attainment is used as a proxy for the quality of the human infrastructure. While this measure leaves much to be desired (Doeringer, Terkla, and Topakian, 1987), it enables us to gauge, albeit imprecisely, some of the effects of human capital on urban employment.

An adjustment is also made for local taxes per capita in a county. This variable is somewhat imprecise for two reasons. First, state taxes are not included. And second, no account is taken of the incidence of the tax, which may be relevant. The effect of this variable cannot be predicted because it may both contribute to, and detract from, a county's business climate.

We also control for population density and population size in a county. The population variables are used to adjust for a variety of factors that may affect the productivity of labor and other business costs in urban areas. The effects of these two variables cannot be predicted. We also adjust for median household income. Finally, dummy variables are used to capture the effects of regional location. These variables help capture the effects of markets and other omitted variables.

The data are for counties that were at least 90% urban in 1980. Of the 128 counties in this class, 113 observations are used. Several urban counties had to be excluded because of the lack of detail on employment. The data on employment are taken from *County Business Patterns 1980* and *County Business Patterns 1984*. The other data are taken from the *County and City Data Book 1983*. Summary statistics are provided below (Table 1). Table 2 provides a simple correlation table for the continuous variables.

Table 1. Summary Statistics for Data Set

	Mean	Standard Deviation
1. Employment growth, 1980–1984	8.3%	11.1%
2. Differential employment shift, 1980–1984 (DS)	3.2%	10.7%
3. Industry mix effect, 1980–1984 (PS)	0.8%	1.9%
4. Median schooling, adults 25 + , 1980 (MS)	12.7 years	0.6 years
5. Educational spending (ES)	$1,233	$282.5
6. Taxes per capita, 1980 (TAX)	$387	173
7. Population density, 1980 (DENS)	2,980/sq mile	7,484/sq mile
8. Population, 1980 (POP)	762,000	922,000
9. Household income, 1979 (INC)	$18,530	$3,670
10. Pacific	13%	34%
11. New England	6%	24%
12. Middle Atlantic	14%	35%
13. East North Central	10%	30%
14. West North Central	10%	30%
15. Mountain	8%	27%
16. West South Central	14%	35%
17. South Atlantic	18%	38%

Total number of cases = 113.

Table 2. Correlation Table

	2. DS	3. PS	4. MS	5. ES	6. TAX	7. DENS	8. POP	9. INC
2. DS	1.000							
3. PS	0.219	1.000						
4. MS	0.409	0.353	1.000					
5. ES	0.013	0.080	0.218	1.000				
6. TAX	−0.112	0.218	0.178	0.673	1.000			
7. DENS	−0.196	0.169	−0.054	0.189	0.593	1.000		
8. POP	−0.165	−0.004	−0.028	0.219	0.301	0.213	1.000	
9. INC	0.366	−0.053	0.623	0.367	0.130	−0.273	−0.027	1.000

Abbreviations: See Table 1.

IV. The Results

Regressions were run to estimate the contributions of the explanatory variables to urban employment growth, 1980–1984 (Table 3) and the differential performance of counties (Table 4). The sign obtained for education spending per pupil is positive, as expected. The results suggest, however, that this variable is neither very important nor statistically significant for explaining urban employment growth or differential performance by a county's industries. It made no difference whether we used expenditures or the natural logarithm of expenditures. The quality of the labor force, measured by its schooling attainment, is a very important and, with one exception (see cases 3 in Tables 3 and 4), statistically significant. Previous research found that income has a positive effect on

Table 3. Estimates of Urban Employment Changes, 1980–1984

	(1)	(2)	(3)	(4)
Schooling Attainment of Adults 25 +, 1980	3.93[a]	7.41[b]	2.59	7.55[b]
Educational Spending/Pupil	.0007	.0035	.002	.006
Local Taxes per Capita	−.011	−.009	−.012	−.012
Population, 1980	−.000001	−.000001	−.000001	−.000001
Population Density, 1980	−.0003	−.0001	−.0002	−.002
Household Income, 1980	.0008[c]		.0011[b]	
Industry Mix	2.04[b]	1.61[b]	1.51[b]	1.04[c]
Pacific			3.19	3.00
Mountain			5.00	4.77
Middle Atlantic			4.28	5.94
East North Central			−5.86	−5.41
West North Central			−3.53	−3.07
West South Central			0.64	0.79
South Atlantic			10.18[b]	9.07[b]
New England			6.29	5.39
Intercept	−54.4	−86.2	−46.6	−92.0
$\bar{R}^2$	.31	.28	.45	.40
F-Ratio	8.21[b]	8.39[b]	7.12[b]	6.24[b]
Degrees of Freedom	105	106	97	98

Of the regional dummy variables, the East South Central region has been omitted.
[a]Significant at the 10% level.
[b]Significant at the 1% level.
[c]Significant at the 5% level.

Table 4. Estimates of Differential Shift, 1980–1984

	(1)	(2)	(3)	(4)
Schooling Attainment of Adults 25 +, 1980	6.24[a]	8.04[a]	3.67	7.55[a]
Educational Spending/Pupil	.0005	.002	.002	.005
Local Taxes per Capita	−.010	−.010	−.010	−.013
Population, 1980	−.000001	−.000001	−.0000004	−.0000005
Population Density, 1980	−.00003	−.0001	−.00003	−.0002
Household Income, 1980	.0005		.0009[a]	
Pacific			2.22	2.01
Mountain			5.27	4.84
Middle Atlantic			4.00	6.14
East North Central			−6.45[b]	−5.51
West North Central			−3.22	−2.55
West South Central			0.88	1.03
South Atlantic			10.82[a]	9.56[a]
New England			4.59	4.53
Intercept	−80.9	−96.5	−60.9	−95.6
$\bar{R}^2$	.19	.18	.35	.31
F Ratio	5.38[a]	6.02[a]	5.31[a]	4.87[a]
Degrees of Freedom	106	107	98	109

Of the regional dummy variables, the East South Central region has been omitted.
[a]Significant at the 1% level.
[b]Significant at the 10% level.

employment growth (Carlino and Mills, 1987; Wasylenko and McGuire, 1985). An explanation of this effect is that income indicates demand and draws firms (Carlino and Mills, 1987, p. 51). The results in both Table 3 and Table 4 suggest that schooling attainment picks up some of the effects of household income, when income is omitted from the estimation, because these variables are somewhat collinear (Table 2). One implication of this result is that income effects in previous research on state and local employment growth may reflect, at least in part, education effects.

The sign for local taxes was negative, as expected, but the statistical significance of this explanatory variable is less than 10%. Population size and population density in 1980 had negative effects on growth and performance, but the coefficients were not significant at the 10% level. This suggests the presence of diseconomies of scale. Household income had a positive effect, and it was statistically significant at the 5% level for explaining urban employment growth. It had a similar effect on relative industrial performance, but the statistical significance was below 10% when no regional dummies were used.

Industry mix had a positive and statistically significant effect on urban employment growth (not applicable to estimates of the differential shift). This is consistent with the findings by Doeringer, Terkla, and Topakian (1987), who found that industry mix had a positive effect on state employment growth.

The effects of the regional dummies are interesting. The dummy variables for the East North Central and West North Central regions show relatively large negative coefficients, though they are not statistically significant at the 10% level for urban employment growth. The coefficient for the East North Central region has a statistically significant negative effect on the differential shift in one case (case 3, Table 4). The

coefficients for the West South Central region are positive but small compared with the coefficients of the other regions, and they are not statistically significant. This suggests that the Central regions, particularly the two North Central regions, were suffering from a disadvantage during the study period. While the Central regions were lagging behind the other regions, the South Atlantic region outperformed the rest of the country, ceteris paribus. The coefficients for this regional dummy variable are large and highly significant.

V. A Further Note on Expenditures on Schooling

Although we could not show statistically significant relationships between expenditures on schooling and employment growth, it does not necessarily follow that financial investments in schooling have no bearing on educational outcomes. Although it is beyond the scope of this article to rigorously examine the determinants of educational outcomes, we have attempted an additional analysis of the effect of expenditures on schooling by estimating the percentage of youth aged 16–17 who were enrolled in school in 1980. We used the same county observations as above.

Following the economic approach to investments in children (Becker, 1981), we adjust for median household income and schooling attainment of adults age twenty-five and older. These variables are proxies for parental income and schooling, which have been found to increase the demand for schooling. Besides expenditures per pupil, we also adjust for population size. The results are as follows.

Enrollment of Youths 16–17

$$74.7 + 0.0006\ \text{Income} - 0.17\ \text{Schooling Attainment}$$
$$(10.0)\quad (6.1)\quad (0.3)$$
$$+0.0035\ \text{Schooling Expenditures} - 0.0000002\ \text{Population}$$
$$(3.0)\quad (0.6)$$

The t statistics are in parentheses. This estimate shows that income and expenditures on schooling have highly significant positive effects on enrollment rates.

VI. Conclusions

Our results suggest that higher levels of educational attainment increase regional employment growth. These returns may spill over into other regions, and larger regions probably are better able to capture the benefits of a more educated labor force.

While schooling attainment has a positive effect on employment growth in urban counties over the study period, educational spending was not important or statistically significant. This result is to be interpreted with care. To measure the effect of the quality of the educational system on employment growth or industry performance, data from below the county level are probably required. Information by school districts, and in big cities even by school, is necessary. The weak results obtained here have to be attributed, at least in part, to this data problem. When school enrollment rating was considered, the level of educational spending did show a significant positive effect, however.

Our results also imply that taxes have no effect on employment growth. This finding

is consistent with studies by Carlino and Mills (1985), Carlton (1983), and Doeringer, Terkla, and Topakian (1987). However, several other studies suggest a negative effect of taxes on state and local growth (Benson and Johnson, 1986; Helms, 1985; Wasylenko and McGuire, 1985). One study even finds a positive relationship between local taxes and employment growth (Plaut and Pluta, 1983).

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References

Becker, G. S. 1981. *A Treatise on the Family*. Cambridge, MA: Harvard University Press.

Benson, B. L., and Johnson, R. N. 1986. The Lagged Impact of State and Local Taxes on Economic Activity. *Economic Inquiry* 24(3): 389–420.

Carlino, G. A., and Mills, E. S. 1987. The Determinants of County Growth. *Journal of Regional Science* 27(1): 39–54.

Carlton, D. 1983. The Location and Employment Choices of New Firms: An Econometric Model with Discreet and Continuous Endogenous Variables. *Review of Economics and Statistics* 65(3):440–449.

Doeringer, P. B., Terkla, D. G., and Topakian, G. C. 1987. *Invisible Factors in Local Economic Development*. New York: Oxford University Press.

Hanushek, E. A. 1986. The Economics of Schooling. *Journal of Economic Literature* 24(3):1141–1177.

Helms, J. L. 1985. The Effect of State and Local Taxes on Economic Growth: A Time Series–Cross Section Approach. *Review of Economics and Statistics* 67(4):574–582.

Herzog, H. W., Jr., and Olsen, R. J. 1977. Shift-Share Analysis Revisited: The Allocation Effect and the Stability of Regional Structure. *Journal of Regional Science* 17(3):441–454.

Krueckeberg, D. A., and Silvers, A. L. 1974. *Urban Planning Analysis: Methods and Models*. New York: John Wiley and Sons.

Plaut, T. R., and Pluta, J. E. 1983. Business Climate, Taxes and Expenditures, and State Industrial Growth in the United States. *Southern Economic Journal* 50(1):99–119.

Wasylenko, M., and McGuire, T. 1985. Jobs and Taxes: The Effect of Business Climate on States' Employment Growth Rates. *National Tax Journal* 38(4):497–512.